HFBR Characterization

Presentation Outline

1. HFBR Characterization History
2. Review of Terminology
3. Characterization Methods and Results
   - A. Activated Components
   - B. HFBR Systems
   - C. Reactor Building Structures
   - D. Ancillary/Support Structures
   - E. Soil Characterization

Review of Terminology

- Characterization:

Identification and measurement of contamination in and around the facility.

- Chemical contamination
- Radioactive contamination and radiation levels

HFBR Characterization History

- December 1996: HFBR shut down for routine work
- 1997 - 1999: Extensive groundwater characterization
- November 1999: Decision to permanently shut down HFBR

HFBR Characterization History

- 2001: Characterization of the HFBR, including reactor, systems, structures, support buildings, and soils
  - Determine current state of the facility in preparation for stabilization and future decommissioning
- 2004 - 2005: Characterization of additional areas
  - Fill in gaps in the previous characterization and estimate the amount of radioactivity present at the HFBR

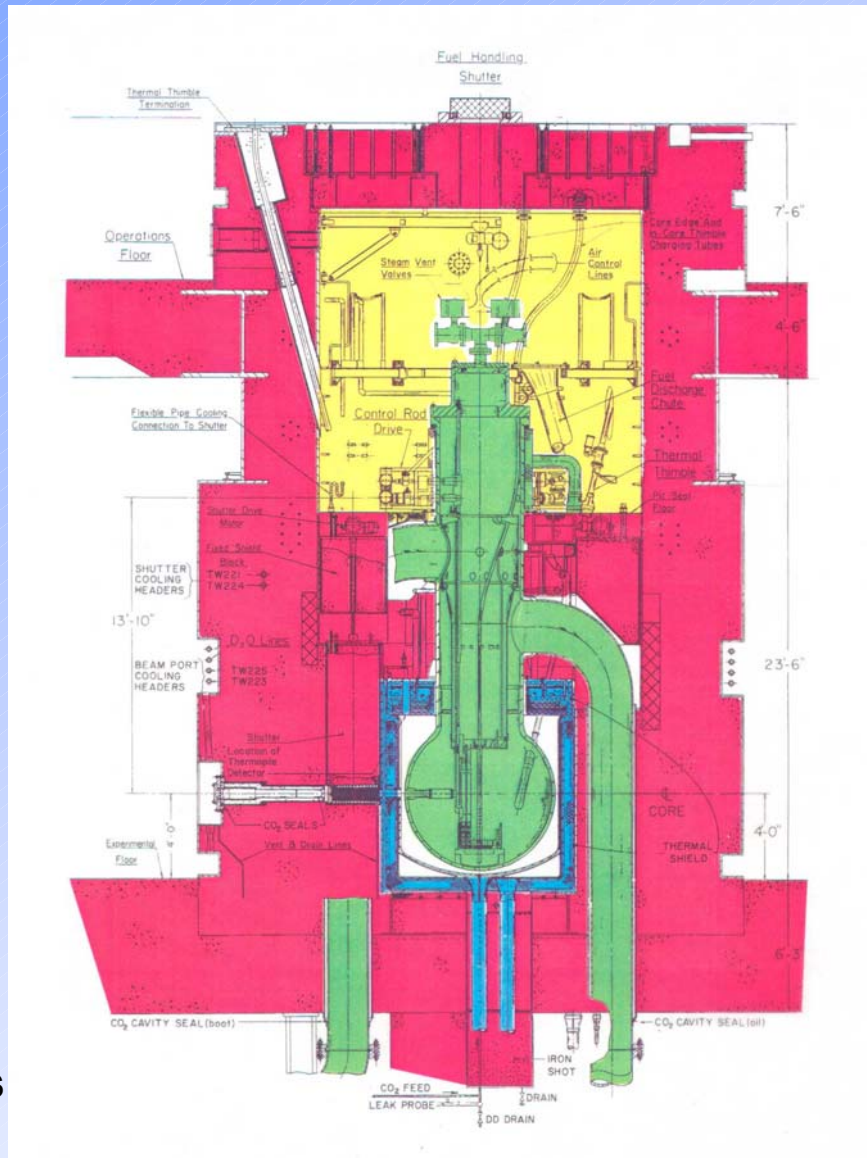
Characterization Results for Hazardous Materials

- Hazardous Materials:
  - Typical of construction materials from facilities built in the 1960's
  - Asbestos Containing Materials in certain floor tiles, ceiling tiles, gaskets, insulation
  - Lead in paint, shielding
  - PCBs in paint and in passenger elevator pit
  - Heavy metals: lead and zinc were detected in wipe samples

Radioactive Materials at HFBR

- What radioactive materials are produced?
- How fast does it “decay” away (half-life)?
- How much is there?
  - Measured in units such as Curies, or picocuries per gram (pCi/g)
- Where is it? Inside a shield, in soil?
- What form is it in? Solid metal, liquid, dust?

How Does Something Become Radioactive?



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HFBR Characterization Methods and Results

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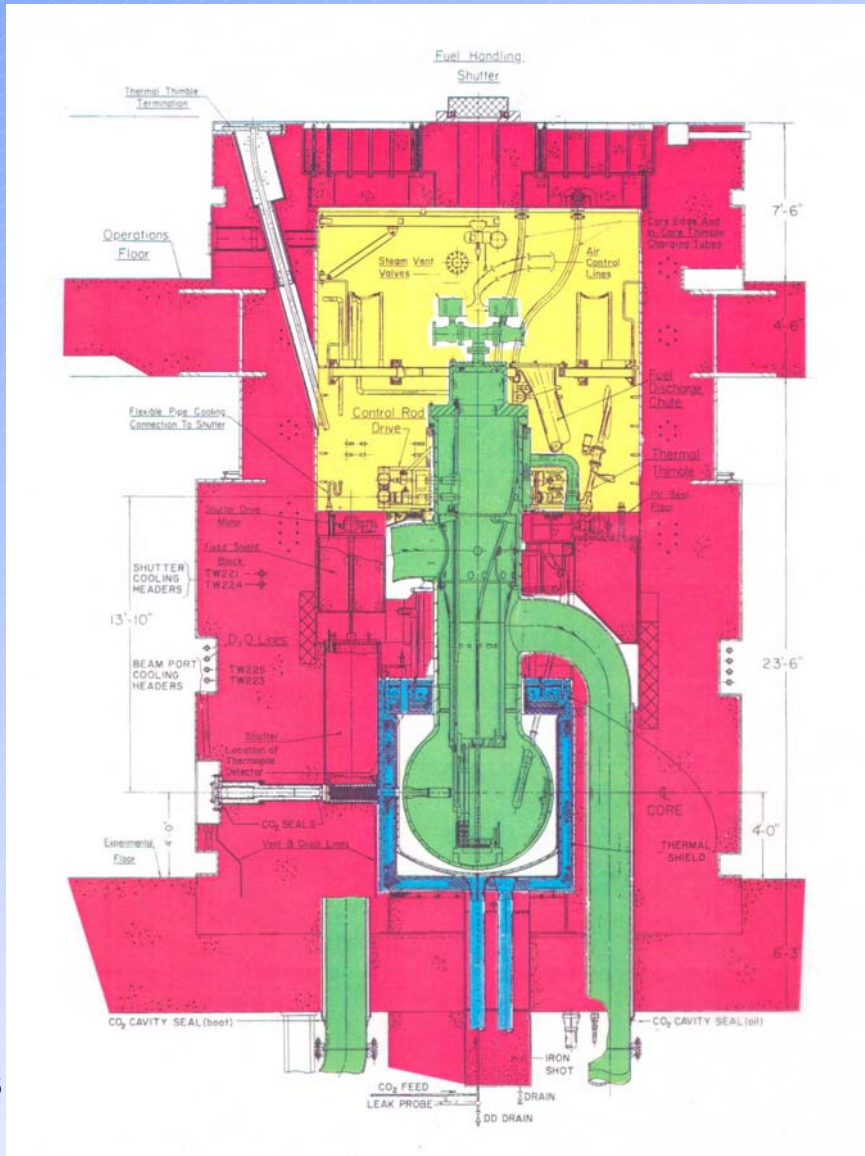
Characterization of Activated Components

	Curies
Reactor Vessel:	1400
Reactor Vessel Internals:	13,400
Control Rod Blades:	291,000
Thermal Shield:	96,400
Biological Shield:	13,300
Total:	416,000



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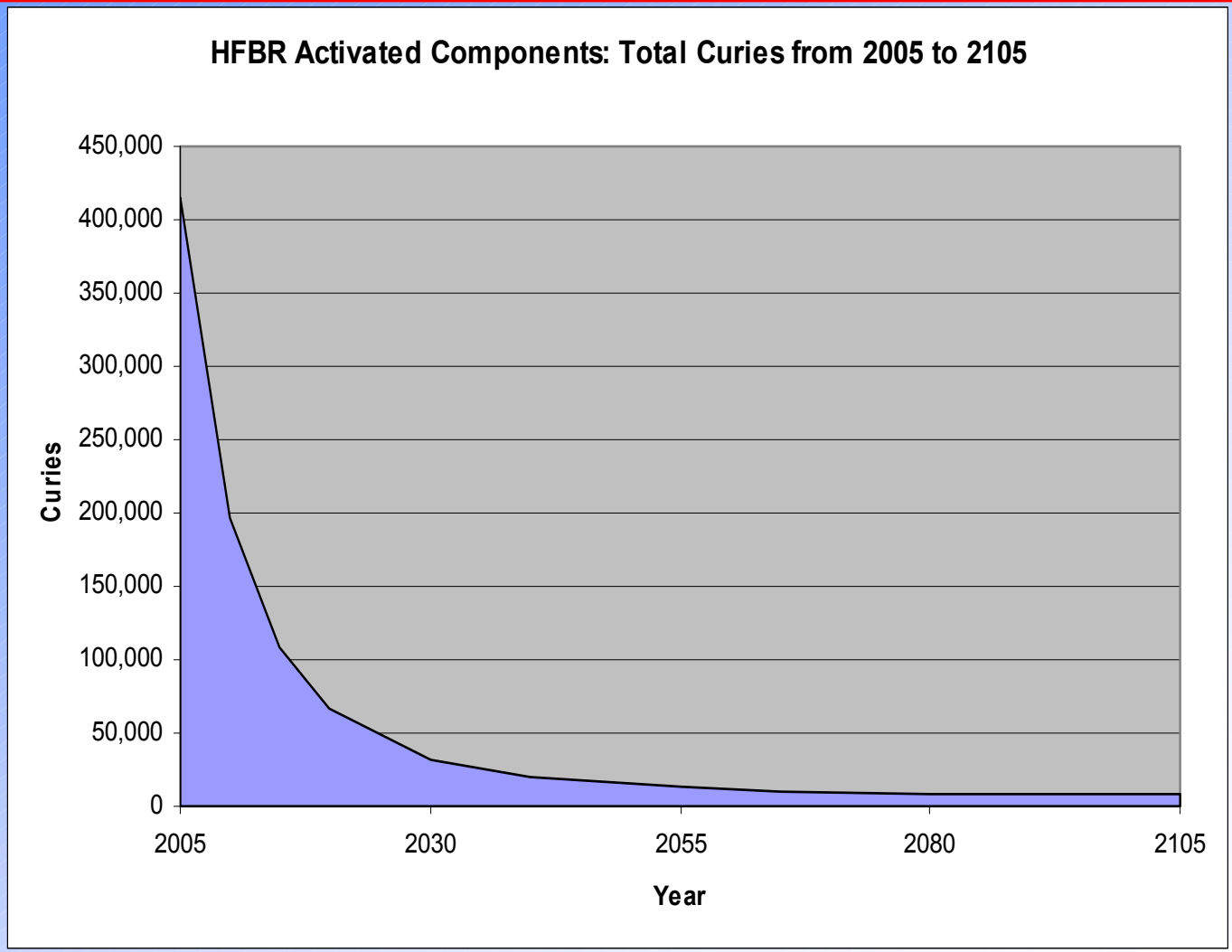
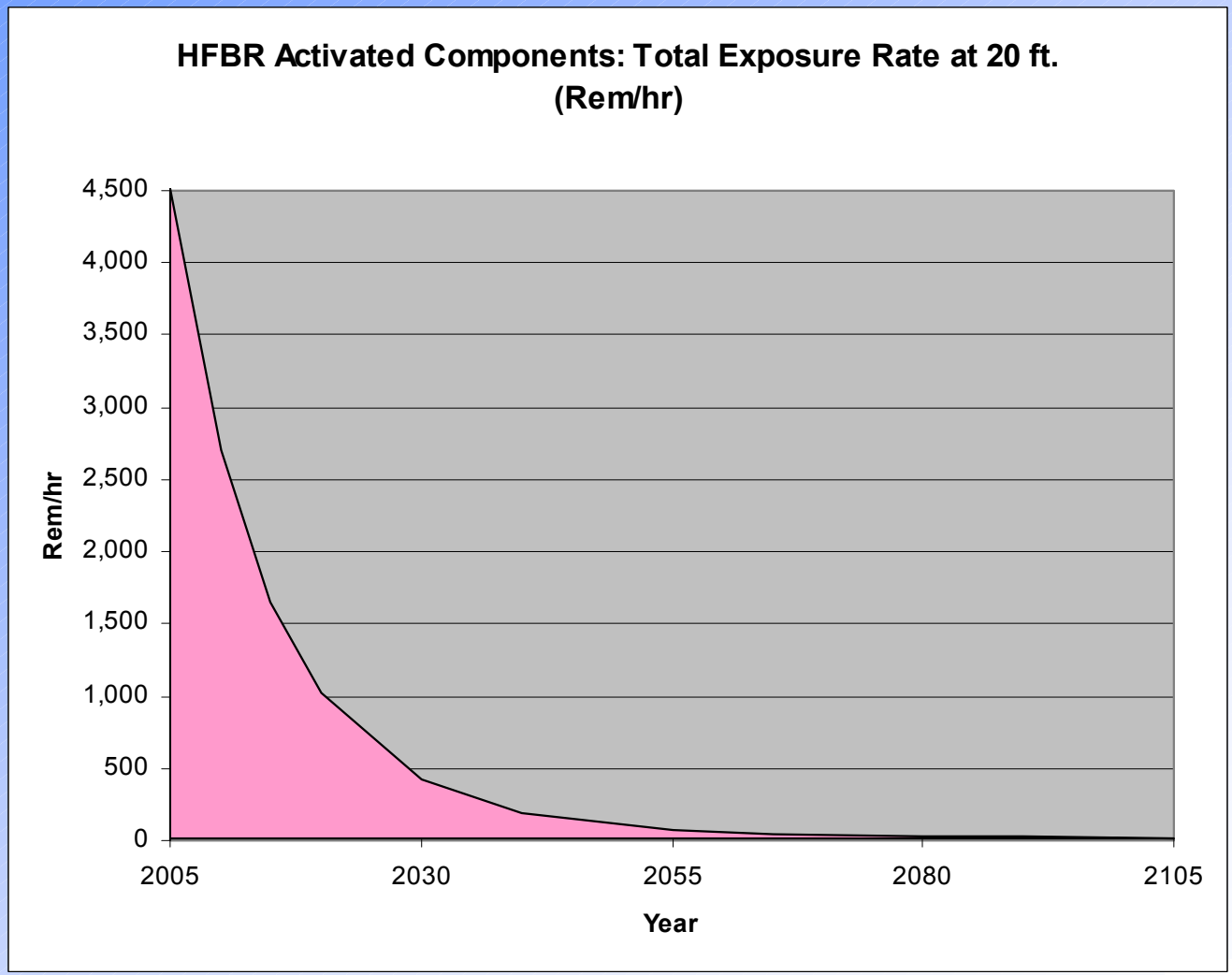
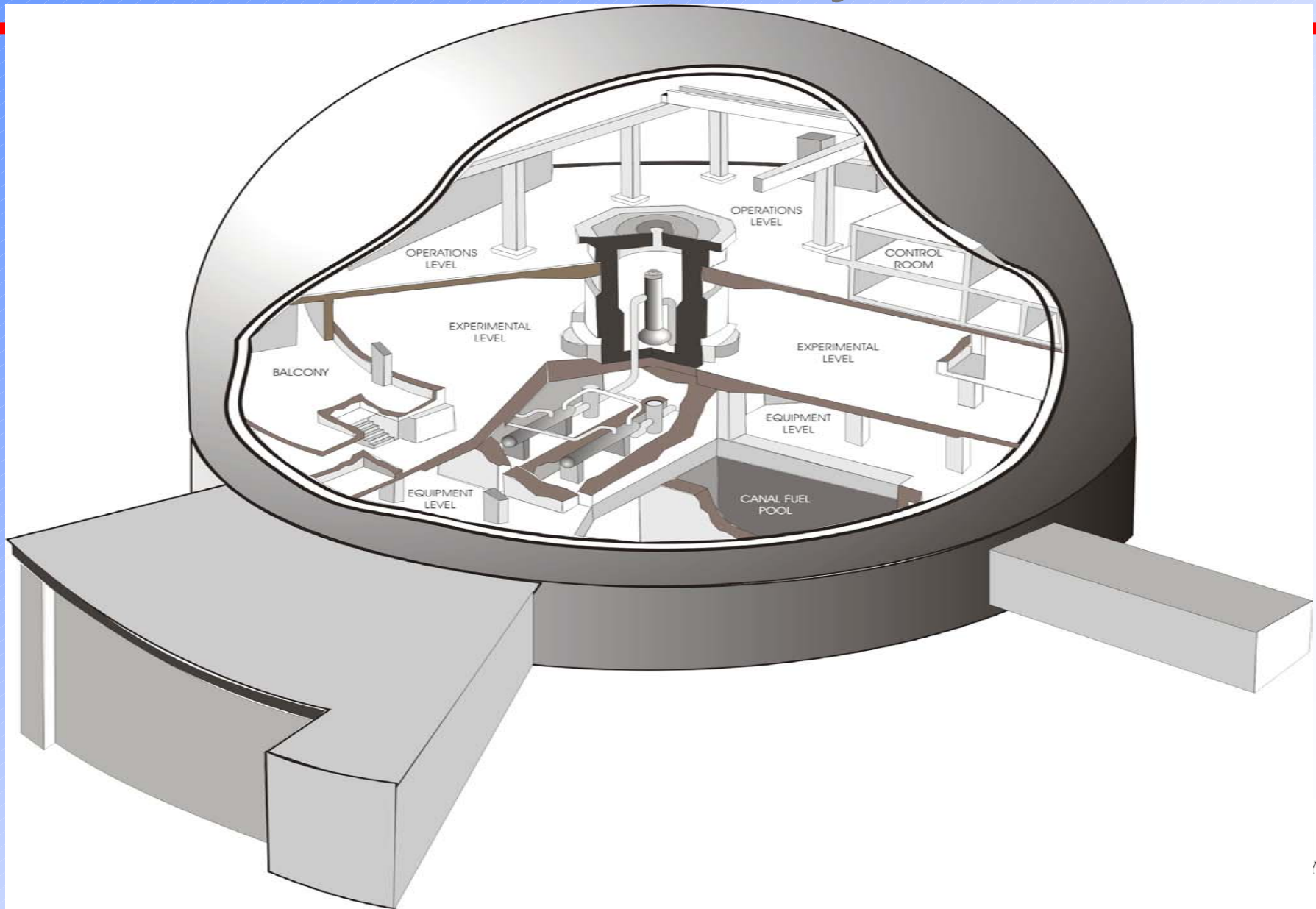
Activated Components - Decay



Activated Components – Radiation Level



Characterization of Systems



Building 750 System Characterization

Curies in 2005

- Primary Coolant and Closely Related Systems . . . . . 45 Ci
- Liquid D/F Waste System . . . . . 5 Ci
- Piping "hot spots" . . . . . 3 Ci

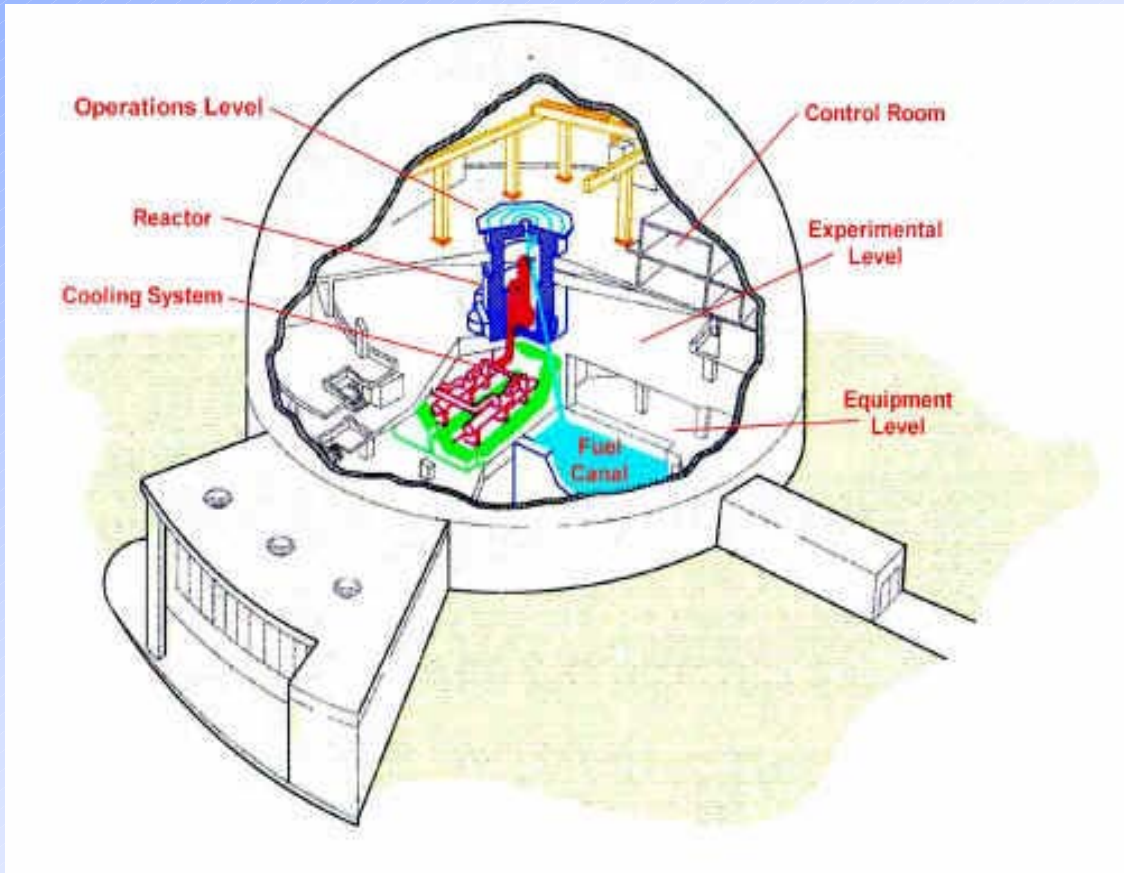
TOTAL . . . . . 53 Ci

About 80% of activity in systems is from Tritium

Characterization of Reactor Building Structures

Structures, Floors, Walls, Dome

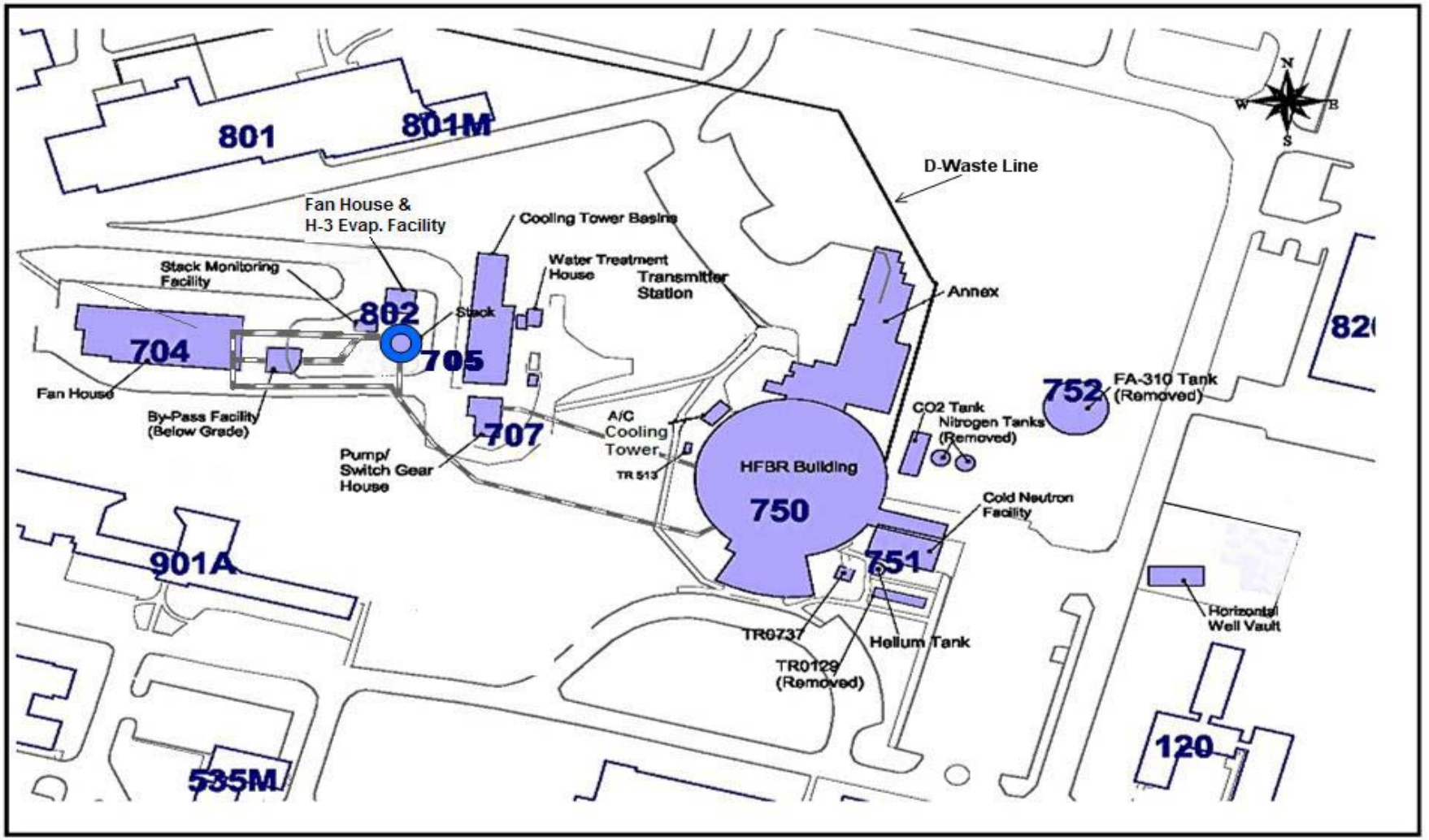
- Operations Level
- Experimental Level
- Equipment Level



Reactor Building Structures

- Generally very low radiation fields, radioactively clean, with some exceptions:
  - Equipment level A, B, and Shutdown Cells contain pumps and heat exchangers that handled primary coolant
  - Access to the reactor top on the Operations Level
  - Certain compartments such as the Beam Plug Storage Facility, and the Refueling Tool Boxes
- Total Tritium in concrete < 0.1 Ci.
- Total contamination from activation and fission products < 0.01 Ci.

Characterization of Ancillary/Support Facilities



Facilities Not Radiologically Contaminated

707/707A: Pump House and Switch Gear

751: Cold Neutron Facility

707B: Water Treatment House

715: Stack Monitoring Facility

Radiologically Contaminated Facilities

704: Fan House

802: Tritium
Evaporation Facility

705: Stack

HFBR Walkover Survey

- Performed comprehensive gamma survey
  - Majority of area determined clean
    - Less than 0.3% of the 6,640 twenty-five ft^2 grids had findings >5,000 cpm above background threshold
- Positive findings
  - Isolated in size, mostly particles, and extent
  - Attributable to past practices
  - Not attributable to chronic leaks, releases, etc.
- 21 findings total
  - All but one cleaned up as part of survey


802
Stack Fan House
705 Stack
707
Cooling Towers
N
W
E
S
15
17
16
18
20
21
19
9
8
7
6
11
10
12
13
14
2
1
5
4
3
750
HFBR
Building
704 Fan House
By-Pass Filter Facility
750
HFBR Annex
Area scanned - Represented in 25 ft² grids
>5,000 cpm identified during initial surface scan
>5,000 cpm remaining after end point survey

Characterization Below HFBR: Methodology

- Designated 6 biased locations
- Core bore through 5 feet of concrete to soil
- Soil samples taken every 2 feet to groundwater (~ 20 samples per location)
- Groundwater samples taken at 48 and 52 feet below the Equipment Level

Characterization Below HFBR: Results

- Tritium found in soil up to 47 pCi/gram at 2 of 6 location
- Tritium found in groundwater from 500 to 7,000 pCi/liter (up to 7 pCi/gram) at 5 of 6 locations
- Potential exists for other higher level pockets of tritium
- Groundwater monitoring continues under OU-3 downgradient of the HFBR

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